This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Original)   A method of synthesizing pulses for a given selective excitation profile in a system including at least one of a two-level quantum system and a subsystem described by the spin domain Bloch equation, comprising the steps of:

    determining frequency envelopes to produce the given selective excitation profile;

    producing a plurality of solutions via an inverse scattering transform producing said envelopes, including identifying and producing a minimum energy solution to said inverse scattering transform for pulses that generate the given selective excitation profile; and

    generating pulses corresponding to any of the plurality of solutions to produce the envelopes that produce said given selective excitation profile.

2. (Original)   A method as in claim 1, wherein said system includes one of a quantum computer system and a spintronics system.

3. (Currently Amended)   A method as in claim 1, wherein said system is a magnetic resonance imaging system, said pulses comprise radiofrequency (RF) pulses, said frequency envelopes ~~comprises~~ comprise RF envelopes, and said selective excitation profile comprises an arbitrary magnetization profile.

4. (Original)   A method as in claim 3, wherein said arbitrary magnetization profile is an arbitrary unit 3 vector valued function of a single real variable.

5. (Original)   The method of claim 3, wherein said solutions producing step comprises the step of using a reflection coefficient corresponding to a hard pulse approximation to approximate an ideal reflection coefficient that is determined by said given magnetization profile.

6. (Original)   The method of claim 1, wherein said solutions producing step comprises the step of specifying bound states and norming constants for reduced scattering data subject to constraints on the energy to be used in said inverse scattering transform.

7. (Currently Amended)   The method of claim 1, comprising the additional step of increasing the energy of ~~the RF~~ a frequency envelope in order to reduce rephasing time while maintaining a constraint on the energy to be used in said inverse scattering transform.

8. (Currently Amended)   The method of claim 1, comprising the additional step of generating a softened pulse approximation to ~~said RF~~ a frequency envelope from the ~~RF~~ pulses generated in said generating step.

9. – 18. (Canceled)

19. (Original) A method of generating a desired frequency dependent excitation in a system including at least one of a two-level quantum system and a subsystem described by the spin domain Bloch equation using selective pulses for a given selective excitation profile corresponding to said desired frequency dependent excitation, comprising the steps of:

    determining frequency envelopes to produce the given selective excitation profile;

    producing a plurality of solutions via an inverse scattering transform producing said envelopes, including identifying and producing a minimum energy solution to said inverse scattering transform for pulses that generate the given selective excitation profile;

    generating pulses corresponding to any of the plurality of solutions to produce the envelopes that produce said given selective excitation profile; and

    applying the generated pulses to said system to obtain said desired frequency dependent excitation.

20. (Original) A method as in claim 19, wherein said system is a magnetic resonance imaging system, said pulses comprise radiofrequency (RF) pulses, said frequency envelopes comprises RF envelopes, and said selective excitation profile comprises an arbitrary magnetization profile.

21. (Original) The method of claim 19, wherein said applying step comprises the steps of generating a softened pulse approximation to said envelopes from the pulses generated in said generating step and applying said softened pulse approximation to said system.

22. – 29. (Canceled)